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## HANGING GARDENS OF THE CANARY ISLAND DATE PALM

Ira L. Wiggins

The practice of trimming the older leaves from the trunks of palms used in ornamental plantings provides a temporary arboreal habitat for a number of plants that normally grow only on the ground. The row of Canary Island date palms on either side of Palm Drive on the campus of Stanford University, California, annually supports a total population of many hundred individual plants and a surprisingly large number of species. The relationships between these plants that are normally ground-dwellers and their arboreal supporters, the fluctuations in the "hanging gardens" from year to year, and the variations in the tenacity of such wanderers marooned above their normal sphere are sources of considerable interest.

Many palms growing under wild conditions retain their leaves over a period of years, thus forming a close thatch that shades out any seedlings that may, upon rare occasions, begin growth on their trunks. But even in such trees, the functional leaves, extending upward at sharp angles, provide catchment basins in the bases of their petioles for decaying organic matter and a small quantity of dust. In cultivated trees a considerable portion of this material remains in the fissures between the basal parts of the petioles after the bulk of the leaves has been pruned from the trunk. The functional leaves above form a natural drainage system that directs much of the intercepted rainwater into the basal parts of the petioles. Some of this water is retained in the cups formed by the petiolar bases, some of it trickles over the rims to enter those below and fill the lower reservoirs. Thus, during the course of a heavy rain the entire trunk of one

of these date palms may become a series of miniature reservoirs, each containing a small quantity of decayed organic matter and rainwater.

Seeds lodged in these pockets find conditions favorable for germination and rapid growth, with the result that many of the palms become decorated with various annual and perennial seedlings. Many of the herbaceous annuals contributing to these hanging gardens live through their entire life cycles before the water supply fails. Such plants reseed the petiolar cups for the next season's growth so the gardens flourish year after year. Even the perennials survive for a surprisingly long time, though few, if any, live long enough in this habitat of limited supplies to produce fruit. Ferns furnish an exception among the perennials, for they produce fertile fronds regularly.

Casual observations made over a period of ten years or more indicate that there are four principal agencies that are effective in sowing seeds in the petiolar bases of the palms. They are: 1, gravity; 2, wind; 3, animal and bird carriers; 4, direct deposition of seed by annuals growing against the trunks of the trees.

Gravity is responsible for the presence of numerous specimens of young palms in the petiolar cups of the parent trees. Falling fruits lodge among the leaf-bases in great numbers and some of their seeds grow. Occasionally seeds of *Acacia* and acorns from the oaks fall among the leaves of the palms. Although *Eucalyptus* trees tower above the palms at a number of places and some of the seeds shattering from the capsules must lodge in the petiolar cups, no seedlings of *Eucalyptus* appear in the arboreal habitat. Their absence is doubtless to be attributed to some factor in the petiolar gardens that is unfavorable to the germination of the seeds of *Eucalyptus* rather than to the failure of the force of gravity!

Birds and small rodents carry acorns, pine nuts, seeds of some species and berries of others from the parent plants to the leaf-bases of the palms before the outer parts of the leaves are removed, or, in the cases of woodpeckers, jays, and squirrels, may hide seeds and nuts among the petiolar bases some distance below the leaf-crown. Robins drop fruit of *Photinia, Pyracantha,* and *Cotoneaster* among the leaves. Waxwings carry these fruits, as well as those of *Schinus molle,* from fruiting plants to other localities, and the purple house finch after eating the berries of *Sambucus,* frequently takes refuge in the palm trees. The habit of wiping beaks on the perches doubtless results in the deposition of some seeds in the crevices among the petiolar bases.

The wind carries seeds of such species as *Ailanthus glandulosa* and *Sonchus oleraceus* to the arboreal habitats, and the same agency is responsible for the presence of *Polypodium* and *Dryopteris* on the sides of palm trunks high above one's head. It is

difficult to explain the absence of such seedlings as those of *Ulmus, Platanus, Senecio* and others with wind-borne seeds.

The most interesting group, however, is made up of those species that do not have wind-blown seeds, do not seem to be used extensively as food by birds and animals, and grow on the ground below the trunks on which some of their number appear season after season. Periodic observations have shown that such annuals as *Stellaria media, Anagallis arvensis, Festuca megalura, Silene gallica, Montia perfoliata,* and *Bromus rigidus* slowly climb higher and higher from one year to another until they occur from the ground to the leaf-crown. An occasional plant of one of these weedy species missed by the gardener's hoe grows against the base of the tree. Its seed capsules or fruiting spikes drop a few seeds into the crevices between the petiolar bases a short distance above the soil and the plant is on its way upward. The plants resulting from the seeds thus sown also grow in close contact with the tree-trunk, mature fruit, and deposit more seeds a few inches higher up the trunk of the supporting palm tree. This progressive ascent may account for the presence of an almost solid growth of annuals from the ground to the leaf-crown on some trees, the almost total absence of them on other trees in the same row.

There is a noticeable lack of hanging gardens on the trunks of fan palms. The attachment of the petioles to the trunk of *Washingtonia filifera,* for example, is such that water is not held in the bases of the petioles. The basal part of the petiole bifurcates, each branch running diagonally downward and about one fifth of the way around the trunk before the main vascular supply enters the trunk of the tree. The increase in diameter of the trunk after the initial departure of the young leaf-traces further splits the base of the petiole and tears the tissue between many of the smaller vascular strands running into the trunk. Thus a considerable portion of the petiolar base is unattached to the trunk of the tree, so water running down from the leaves above percolates through the fibrous strands enwrapping the trunk to enter the soil at the base of the tree. Therefore the trunk of the tree and the crevices between the petiole bases dry out too rapidly to permit the growth of even the short lived annuals.

Some perennials survive in the crevices among the petiolar bases on the date palms for several years. Seedlings of *Pinus radiata* five years old, of *Pinus Sabiniana* three years old, and of *Quercus agrifolia* nine years of age are not infrequent on the trunks of date palms along the drive on the Stanford campus. Plants of *Polypodium californicum* and of *Dryopteris arguta* are now under observation for the sixth successive year. A specimen of *Eriobotrya japonica* (loquat) that started as a seedling in a petiolar base of a date palm in front of the Museum Building reached the leaf-crown of the palm, nearly twenty feet above its

roots, before being removed by the gardeners. However, this seedling started only a couple of feet above the ground, so its roots soon found their way into the soil, and its period of dependence on the scanty supply of soil and moisture in the petiolar cups was comparatively short.

It would be interesting to know something about the fluctuations in the available moisture in these cups, and whether the perennials die on account of water shortage or through the exhaustion of the essential mineral elements entrapped in the petiolar crevices.

The following list includes only those species observed growing on the date palms on the Stanford campus and in park ways near my home. A more extensive survey might expand this list considerably.

Acacia retinodes Schlecht.
Ailanthus glandulosa Desf.
Anagallis arvensis L.
Avena fatua L.
Bromus mollis L.
Bromus rigidus Roth.
Cupressus Macnabiana Murr.
Cupressus macrocarpa Hartw.
Dryopteris arguta (Kaulf.) Watt.
Eriobotrya japonica Lindl.
Echinocystis fabacea Naud.
Festuca megalura Nutt.
Festuca myuros L.
Hordeum murinum L.
Montia perfoliata (Donn) Howell
Phoenix canariensis Hort.
Pinus radiata Don
Pinus Sabiniana Dougl.
Prunus communis L.
Prunus ilicifolia Walp.
Polypodium californicum Kaulf.
Quercus agrifolia Née
Pyracantha sp.
Sambucus glauca Nutt.
Silene gallica L.
Solanum nigrum L.
Sonchus oleraceus L.
Stellaria media (L.) Cyr.
Thuya orientalis L.
Verbena prostrata R. Br.

Dudley Herbarium,
Stanford University, July, 1938.

## ADDITIONS TO OUR KNOWLEDGE OF THE FLORA OF MOUNT BAKER, WASHINGTON

W. C. Muenscher

Mount Baker, with its cap of perpetual ice and snow, attaining a height of 10,750 feet above sea level, dominates the landscape of Whatcom County, Washington, the northwest corner of the United States. In 1929 St. John and Hardin (3) published a flora of this area reporting its known flora as consisting of 334 species and varieties.